Rapid single-step induction of functional neurons from human pluripotent stem cells.

Journal: Neuron

Publication Year: 2013

Authors: Yingsha Zhang, Changhui Pak, Yan Han, Henrik Ahlenius, Zhenjie Zhang, Soham Chanda, Samuele Marro, Christopher Patzke, Claudio Acuna, Jason Covy, Wei Xu, Nan Yang, Tamas Danko, Lu Chen, Marius Wernig, Thomas C Sudhof

PubMed link: 23764284

Funding Grants: Cellular tools to study brain diseases affecting synaptic transmission

Public Summary:

Available methods for differentiating human embryonic stem cells (ESCs) and induced pluripotent cells (iPSCs) into neurons are often cumbersome, slow, and variable. Alternatively, human fibroblasts can be directly converted into induced neuronal (iN) cells. However, with present techniques conversion is inefficient, synapse formation is limited, and only small amounts of neurons can be generated. Here, we show that human ESCs and iPSCs can be converted into functional iN cells with nearly 100% yield and purity in less than 2 weeks by forced expression of a single transcription factor. The resulting ES-iN or iPS-iN cells exhibit quantitatively reproducible properties independent of the cell line of origin, form mature pre- and postsynaptic specializations, and integrate into existing synaptic networks when transplanted into mouse brain. As illustrated by selected examples, our approach enables large-scale studies of human neurons for questions such as analyses of human diseases, examination of human-specific genes, and drug screening.

Scientific Abstract:

Available methods for differentiating human embryonic stem cells (ESCs) and induced pluripotent cells (iPSCs) into neurons are often cumbersome, slow, and variable. Alternatively, human fibroblasts can be directly converted into induced neuronal (iN) cells. However, with present techniques conversion is inefficient, synapse formation is limited, and only small amounts of neurons can be generated. Here, we show that human ESCs and iPSCs can be converted into functional iN cells with nearly 100% yield and purity in less than 2 weeks by forced expression of a single transcription factor. The resulting ES-iN or iPS-iN cells exhibit quantitatively reproducible properties independent of the cell line of origin, form mature pre- and postsynaptic specializations, and integrate into existing synaptic networks when transplanted into mouse brain. As illustrated by selected examples, our approach enables large-scale studies of human neurons for questions such as analyses of human diseases, examination of human-specific genes, and drug screening.

Source URL: https://www.cirm.ca.gov/about-cirm/publications/rapid-single-step-induction-functional-neurons-human-pluripotent-stem-cells